

Fun4All TPC Material and Digitization

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- ❑ Fun4All TPC: https://github.com/sPHENIX-Collaboration/macros/macros/G4_Svtx_maps_ladder_....C
- ❑ TPC **Performance Parameters** (gas dependent)
 - Smear to mimic avalanche $\sigma_T = 300 \mu m$ – constant for all gasses
 - Drift velocity
 - Transverse diffusion
 - Long. Diffusion
 - dEdX
 - Number of primaries / cm
 - Number of total / cm
 - Electrons per keV = Number of total / dEdx
- ❑ TPC **readout shaping time and ADC clock parameters** – set the Z size of the TPC cells
 - ADC clock = 53.0 ns (18.8 MHz ADC clock rate)
 - Shaping RMS lead = 32.0 ns and Shaping RMS tail = 48.0 ns (based on 80 ns SAMPA)
 - Cell Z = ACD clock * Drift velocity
 - Smear $R-\phi = 0.25$ and Z smear = 0.15 – fudge parameters tuned to give avg. $150 \mu m$ $r - \phi$ and $500 \mu m$ Z resolutions (outer TPC layers)

❑ Predefined gas selections – what are the 100 numbers?

- Ne2K (100, 400)
- NeCF4 (100, 300, 400) – simulation selection (ether)
- By hand setting
- Simulation default gas *sPHENIX_TPC_Gas* : Ne(90%) CF4(10%) - defined in g4main/PHG4Reco.cc

❑ Support material

- Inner/outer cage: $L = 211 \text{ cm}$, $\chi_0 = \chi_0^{\text{Kapton}} * \chi_0^{\text{Material}}$, $\chi_0^{\text{Material}} = 1.13 \times 10^{-2}$, $\chi_0^{\text{Kapton}} = 28.6 \text{ cm}$
- Inner field cage R = 20 cm, Outer field cage R = 78 cm
- Readout radius = 30 cm

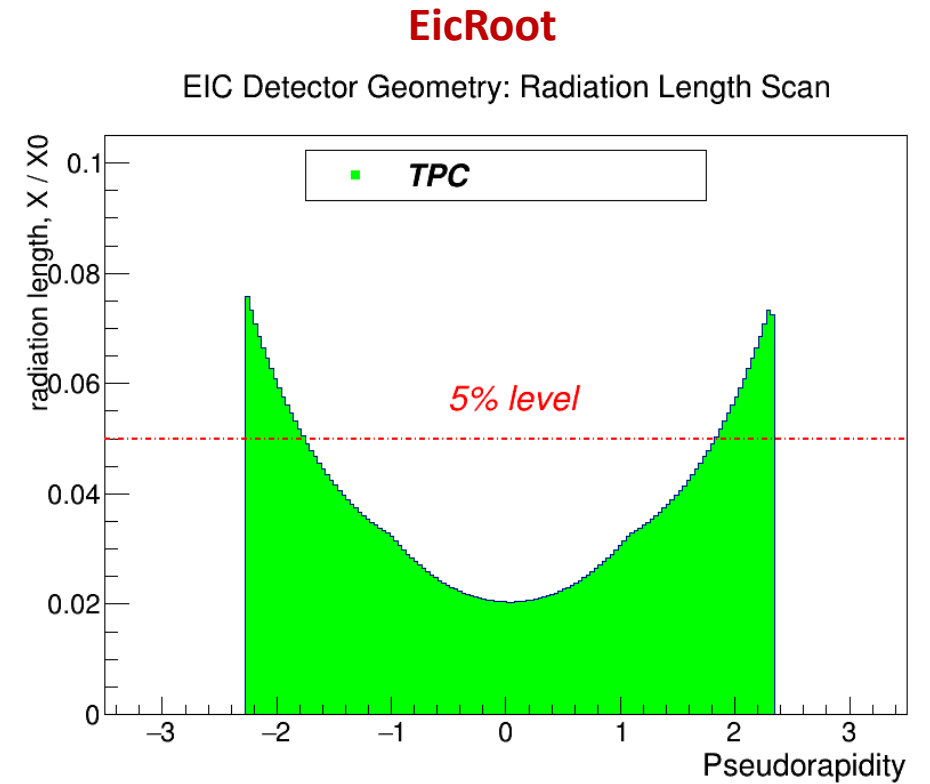
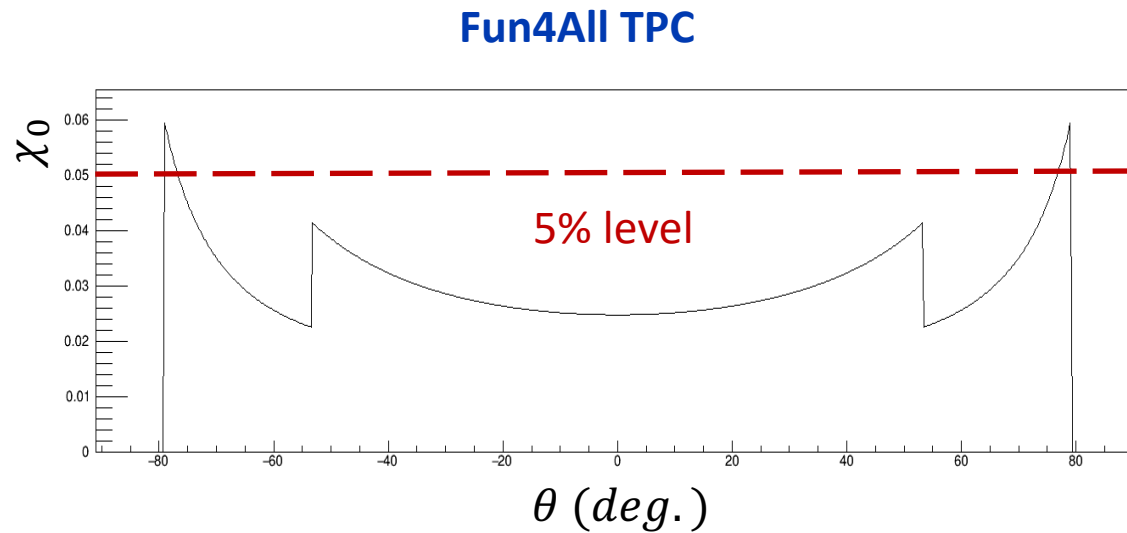
❑ Active Gas layers (16 layers per section, each layer 1.25 cm thick)

- Inner: 30-40 cm, r-phi count = 1152
- Mid: 40-60 cm, r-phi count = 1536
- Outer: 60 – 78 cm, r-phi count = 2304 – r-phi counts?

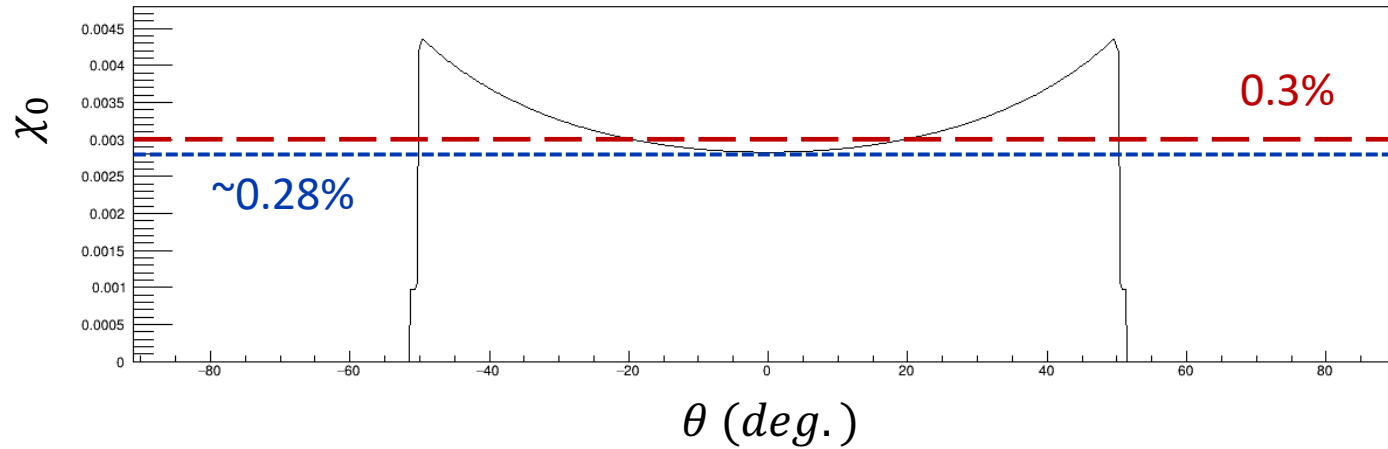
➤ “Fast Simulation” appears to not use the gas dependent parameters etc. Resolutions are

- Radial resolution = 1 cm, phi-res = 200 μm , long-res = 500 μm

- ☐ “Fast Simulation” TPC material scan ($\theta = 0^\circ \rightarrow 90^\circ$ to beamline)

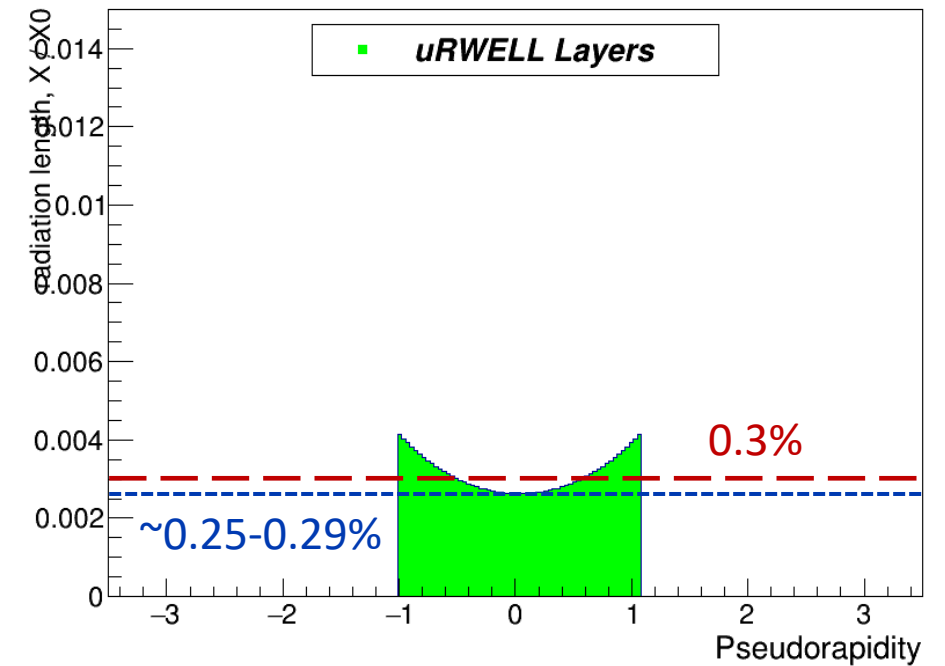


Fun4All (3 cm drift gap)



EicRoot (1.5 cm drift gap)

EIC Detector Geometry: Radiation Length Scan



□ What to focus study on in Fun4All

○ *Fast Simulations*

➤ *Validation between EicRoot and Fun4All?*

- *What setup to validate?*

➤ *Repeat studies of TPC and TPC + MPGDs and then add forward trackers?*

○ *Micro-Rwell material*

➤ *Add simple support structure material?*

➤ *Implement multiple hit capability (e.g. several sensitive layers)*

○ *Full simulation*

➤ In addition to micro-Rwell material updates also need to define a digitization

- *Implement $u - v$ readout*